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The Effect of the VAT Rate Change on Aggregate Consumption and Economic Growth

Bumpei Miki

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Bumpei Miki[1]

Abstract

The purpose of this paper is to empirically determine the effect of a change in a country's Value Added Tax (VAT) rate on its aggregate consumption and its economic growth. As for the effect on aggregate consumption, this paper removes the income effect and discusses only the substitution effect. Using panel data models on a sample covering up to 14 developed countries, including Japan, and quarter periods from the second quarter in 1980 (1980 Q2) to the third quarter in 2010 (2010 Q3) and picking up 53 cases of the change of the VAT rate, this paper shows empirically that aggregate consumption and economic growth display three kinds of trends when the VAT rate is changed. The first trend is that aggregate consumption and economic growth increases [or decreases] just before the rise [or reduction] of the VAT rate. The second trend is that they decrease [or increase] relatively dramatically as soon as the rise [or reduction] is implemented. The third trend is that after the dramatic decrease [or increase] they increase [or decrease] gradually.

Section 1: Introduction

Governments raise taxes for public expenditure, ranging from social security to national defense, education, and infrastructure like highways or airports. The question is what kinds of taxes are raised and what sorts of effects they have. In particular, the difference between income taxes and consumption taxes is important.

Consumption taxes are mainly divided into two types. One is general consumption taxes, which are imposed on an extensive range of goods and services. They are usually VATs. The other is excise taxes, which are imposed on specific goods and services like alcoholic drinks, tobacco, gasoline, etc.

There are several characteristics to notice in general consumption taxes. First, it is often said that general consumption taxes are better for economic growth than income taxes because of their effect on savings and on labor supply. Since general consumption taxes do not impose on savings while income taxes impose on savings and on the income from savings (interest), general consumption taxes can

[1] Bumpei Miki: A visiting fellow of the Center on Japanese Economy and Business (CJEB) at Columbia University from September 2010 to May 2011 (mikibumpei@hotmail.co.jp). The views expressed in this working paper are mine and do not necessarily represent those of CJEB. I wish to thank Jaejoon Woo at International Monetary Fund (IMF) who gave me a basic idea on empirical methodology of this paper.

encourage savings, leading to increased investment and growth. Also, general consumption taxes do not affect people's decisions about whether or not to work, while the progressive income tax system, make people reluctant to work since a higher tax rate will be imposed when people work harder and earn more. General consumption taxes encourage savings and labor supply rather than income tax and subsequently have a positive effect on economic growth.

The second characteristic is that general consumption taxes improve competitiveness. The argument that general consumption taxes promote international competitiveness is made most strongly in the comparison between the VAT and corporate tax. Corporate taxes increase the cost of capital and hence the cost of production, thus making it more difficult for the affected firms to compete in foreign markets. In contrast, the VAT is refunded on exports and so has no effect on the ability of domestic firms to export. From this view, general consumption taxes are better for domestic economic growth than income taxes.

The third characteristic is that general consumption taxes increase inequality between the rich and the poor compared to income taxes. This is clear because income taxes are generally progressive while general consumption taxes are proportional. Also, since both savings and capital income are more highly concentrated at the top of the income distribution than labor income in general for developed countries, a change from income taxes to consumption taxes, which improves the incentive to save and reduces the taxation of capital income, would lead to increased inequality. In order to weaken this negative effect of consumption taxes on income distribution, many countries adopt reduced VAT rates for necessities such as food and newspapers.

These three characteristics imply that a government will raise the share of consumption taxes or income taxes depending on how it assesses the positive effects on economic growth and negative effects on income distribution.

According to Organization for Economic Co-operation and Development's (OECD's) Policy Brief in 2007, 29 of the 30 OECD countries have a VAT. Although the revenue of consumption tax has declined from 1965 to 2005 (most of the reduction has taken place between 1965 and 1975) because of a decrease in revenues from excise duties and other specific taxes, VAT revenue as a percentage of total tax revenue has been rising, as seen in Table 1. VAT has become more important for developed countries. OECD also argues that countries with increased revenue shares from taxes on consumption have all experienced higher revenue shares from general consumption taxes and all the countries with reductions in the revenue shares of general consumption taxes have experienced lower tax revenue shares from all taxes on consumption from 1995 to 2005. Some countries have experienced an increased share of revenues from general consumption taxes at the same time as a reduced share from taxes on consumption as a whole. This illustrates the fact that revenues from general consumption taxes (and the VAT in particular) have grown faster across the OECD as a whole than all consumption taxes.

Table 1

Revenue shares of major taxes in the OECD area (Unweighted average, %)

	1965	1975	1985	1995	2005
Personal income tax	26.2	29.8	29.7	27.1	24.6
Corporate income tax	8.8	7.6	8.0	8.0	10.3
Social security contributions	17.6	22.0	22.1	24.7	25.6
Payroll taxes	1.0	1.3	1.1	0.9	0.8
Property taxes	7.9	6.3	5.2	5.5	5.6
Tax on Consumption	38.4	32.8	33.7	32.4	31.9
(Of which, VAT and sales tax)	13.6	14.5	16.4	17.7	18.9

(Source) OECD Policy Brief "Consumption Taxes: the Way of the Future?" (Oct, 2007)

Recently, more governments have become interested in using a VAT to finance a larger share of spending. Germany increased its VAT rate at the beginning of 2007, partly to finance a cut in social security contributions. The United Kingdom also raised its VAT rate for its fiscal consolidation. Governments in developed countries appear to prioritize economic growth and competitiveness over income distribution. The trend of the increasing VAT rate may continue into the foreseeable future. The question in this paper is what sort of effects a change in the VAT rate has on the economy.

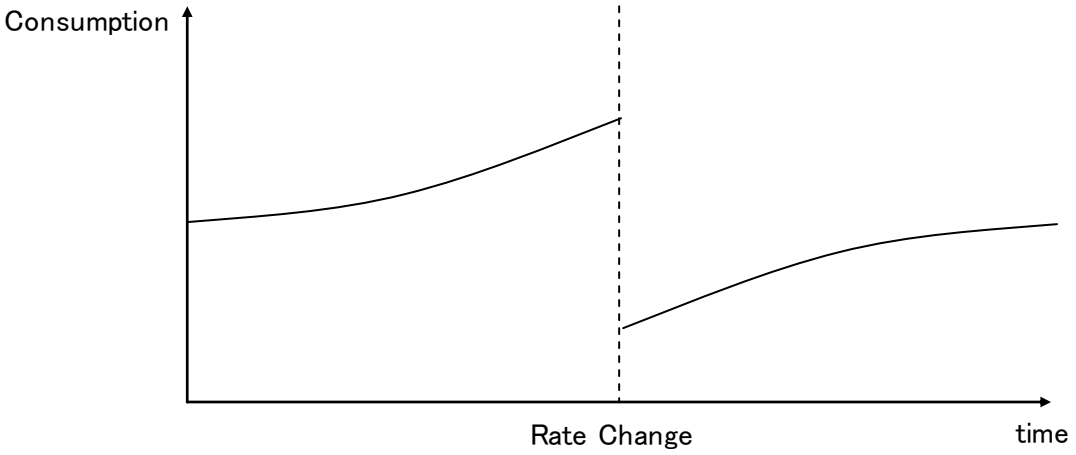
An increase in the VAT rate of a country often arouses public interest and sometimes becomes an important factor for elections. Many people believe that a rise in the VAT rate will have a bad effect on aggregate consumption and will weaken economic growth. Similarly, a reduction in the VAT rate is sometimes an argument for strengthening economic growth by stimulating aggregate consumption under a recession. However, some people insist that the effect on aggregate consumption and economic growth is limited. Although there is a decline of aggregate consumption and economic growth after raising the VAT rate, there is also an increase of aggregate consumption and economic growth before the raise that will offset the negative effect after the raise. Other economists say that people should not fear the negative the effect of the VAT rate because the decline is only temporary.

The income effect on the aggregate consumption is clearly negative because the rise in the VAT rate will decrease people's dispensable income. In addition to income effects, a change in the VAT rate has a substitution effect, which means even if the government reduces the income tax rate in order to offset the decrease in people's income due to the rise of the VAT rate, aggregate consumption will change.[2]

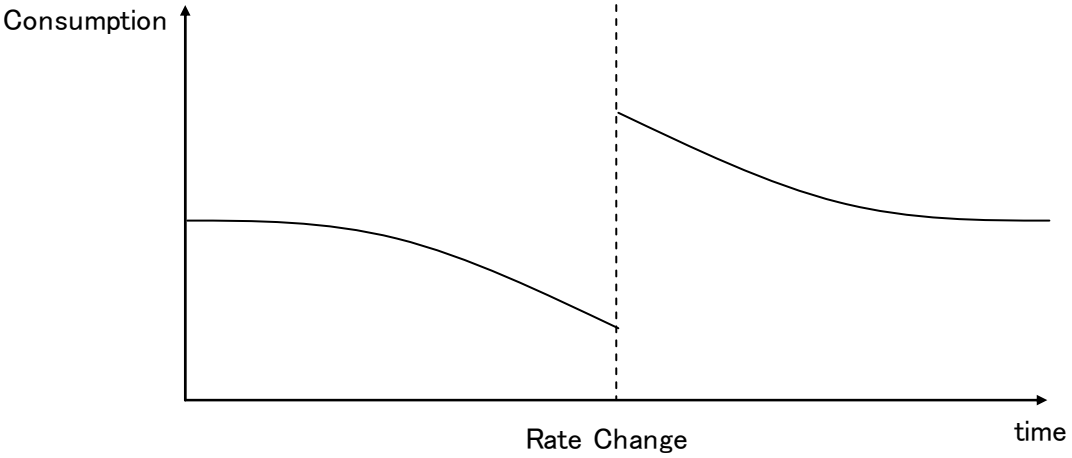
[2] For example, most European countries introduced the VAT rather than the abolition of sales tax. In theory, even if the VAT revenue was equal to sales tax revenue, the consumption should have been decreased by the substitution effect.

In theory, if there is an announcement that the government will raise the VAT rate, people will buy items which can be stocked before the rise of the VAT rate. After the rise in the VAT rate, the aggregate consumption will decline because people will use their stock instead of buying new items. After that, the aggregate consumption will grow up gradually as people run out of their stock and need to buy new items. The movement of aggregate consumption when the VAT rate is raised will be like Graph 1. Similarly, the movement of aggregate consumption when the VAT rate is reduced will be like Graph 2.

Graph 1



Graph 2



Economic growth is expected to move as well as aggregate consumption because the aggregate consumption is a component of GDP. Taking into account the fact that the negative [or positive] income effect of the rise [or reduction] of the VAT rate on the change of aggregate consumption occurs

only in the period just after the implementation of the rise [or reduction], the sign of the income effect is the same as the substitution effect. Since economic growth is affected both by the income effect and the substitution effect, its trend is still same. It will be like Graph 1 when the VAT rate is raised and like Graph 2 when the VAT rate is reduced.

Thus, the effect of the change of the VAT rate on aggregate consumption and economic growth is easily understood theoretically, but it is difficult to grasp the significance of this effect in practice. It goes without saying that aggregate consumption and economic growth are not determined only by the change in the VAT rate. There are many papers on the determinants of the change of aggregate consumption and economic growth. William Hamburger (1954) shows the aggregate consumption is determined by the income, wealth, interest rates, the age distribution of the population etc. Robert J. Barro (1991) presents there are a variety of determinant of the economic growth such as investment, human capital, etc.

The question is whether the effect of the change in the VAT rate is significant or ignorable compared other determinants. If the effect is so small that people can ignore it, the effect will be statistically insignificant. The purpose of this paper is to make sure that aggregate consumption moves like Graph 1 [Graph 2] due to the substitution effect when the VAT rate is changed. There are three main points. First, aggregate consumption and economic growth will increase [or decrease] before the rise [or reduction] of the VAT rate. Second, they will decrease [or increase] dramatically as soon as the VAT rate is raised [or reduced]. Third, they will increase [or decrease] gradually after the reduction [or increase].

The paper continues as follows: section 2 presents the determinants of aggregate consumption and of economic growth, section 3 presents the empirical methodology and describes dataset, section 4 discusses the empirical results, and section 5 concludes the paper.

Section 2: The determinants

(1): The determinants of the change of aggregate consumption

1. Change of dispensable income

Although there are many studies of consumption function, the most classic and basic individual consumption function is $C = c_0 + c\ (Y - T)$, where C stands for the individual consumption, c_0 for the necessary consumption that is independent of income, Y for the income of the individual, T for the tax payment of the individual and c as a parameter. (Y - T) means the individual dispensable income. Since the aggregation consumption is the total of the individual consumption in the country, the aggregate consumption function includes the total of individual dispensable income which can be obtained by subtracting the total tax revenue from the GDP which is equal to the total of individual incomes.

Incorporating the dispensable income change, the income effect of the change in the VAT rate is

removed and there remains only the substitution effect. This regression estimates the substitution effect of the change in the VAT rate.

2. Expected inflation rate (Expected change of the price)

An increase in the expected future price will affect current consumption positively or negatively, depending on the relative importance of the income effect to the substitution effect. On one hand, expected inflation (the higher expected future price) makes people spend less money because the real income will decrease and people want to save money for the future. The income effect here is negative. On the other hand, inflation provides an incentive to buy things which can be stored at lower prices in the current period. The substitution effect here is positive. The effect of the change of price depends on which of these tendencies predominates.

Taking into account the fact that the VAT rate is a component of Consumer Price Index (CPI), expected inflation rate increases [or decreases] in the period just before the government raises [or reduces] the VAT rate because people can easily expect CPI inflation from the government's announcement about the rise [or reduction] of the VAT rate.

3. Change of interest rate

As well as expected inflation rate, the effect of the change of interest rate is positive or negative depending on the relative importance of the income effect to the substitution effect. On one hand, an increase of the interest rate makes it possible to spend more currently thanks to the larger interest revenue, and the income effect is positive. On the other hand, the higher interest rate provides an incentive to raise future consumption at the expense of the current period, and the substitution effect is negative. Which of these effects predominates depends on the tastes of the consumers who must choose between current and future consumption.

4. Change of VAT rate

This is the key factor in this paper. As we see so far, the rise [or reduction] in the VAT rate will make aggregate consumption move like Graph 1 [Graph 2]. Since the larger change will have the larger effect, it makes sense to take the amount of the change into account.

In order to determine the effect of the change of VAT rate, the date and the amount of the tax rate change are researched for 14 countries (Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Portugal, Spain, Sweden, and United Kingdom).[3] Table 12 shows the result. There are 53 cases of the change in the VAT rate.

[3] I tried to pick up data from all OECD countries, but I needed to reduce the number of countries because some OECD countries did not raise their consumption tax rate from 1980 Q2 to 2010 Q3 or because some countries are missing values for several variables.

In order to determine the effect of the change in the VAT rate, this paper uses 3 variables; C(T), C(T-1), C(T+1). C(T) is the amount of the change in the VAT rate at the beginning of the period T (if there is no change at period T it is 0 like a dummy variable). C(T+1) is the amount of the change in the VAT rate in the previous period. Similarly, C(T-1) is the amount of the change in the VAT rate in the next period.[4]

As Table 12 shows, the date of the rise in the VAT rate is not always the beginning of the quarter. This paper regards the change in the VAT rate in the first month of the quarter (January, April, July, October) as the change at the beginning of the quarter. The change in the middle or the last month of the quarter (February, March, May, June, August, September, October, and November) is regarded as the change at the beginning of the next quarter. In this case, this paper regards C(T-1) as 0.[5]

Most countries adopt a reduced rate for the VAT, but this paper ignores the change of the reduced rate and focuses only on the standard rate. In many countries, reduced rate is applied to the commodities such as food, newspapers, medicine etc. Since they are needed in daily life, the substitution effect is so weak that this paper ignores the change of the reduced rate for estimating the effect on aggregate consumption.

(2): The determinants of economic growth

This paper regards economic growth as GDP growth per capita. The regression is done both for nominal growth and real growth.

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[4] For example, Japan raised the VAT (consumption tax) rate by 3% in 1989. 4. 1 and by 2% 1997. 4. 1. In this case, C(T) is 3 in 1989 Q2 and 2 in 1997 Q2 and 0 in all other periods. C(T+1) is 3 in 1989 Q3 and 2 in 1997 Q3 and 0 in all other periods. Similarly, C(T-1) is 3 in 1989 Q1 and 2 in 1997 Q1 and 0 in all other periods. This is like a dummy variable but the value is not only 0 and 1 but also the amount of the change of the VAT rate in order to take account of the magnitude of the change.

[5] This part may be difficult to understand. For example, in the case that France raised the VAT rate by 2% at 1995. 8. 1. (during 1995 Q3), C(T) in 1995 Q4 is 2, C(T+1) in 1996 Q1 is 2 and C(T-1) in 1995 Q3 is 0.

If our assumption that aggregate consumption and economic growth move like Graph 1 or Graph 2, aggregate consumption and economic growth in 1995 Q3 will be between that in 1995 Q2 and that in 1995 Q4. Aggregate consumption and economic growth will decrease from 1995 Q2 to 1995 Q3, and continue to decrease from 1995 Q3 to 1995 Q4, and reverse to increase from 1995 Q4 to 1996 Q1. The decrease occurs twice. It is different from the case that the VAT rate is raised at the beginning of the quarter, in which the decrease occurs only once. Since this paper expected the sign of coefficient of C(T-1) to be positive, that of C(T) is negative and that of C(T+1) is positive, elimination of C(T-1) is needed because our assumption expect that the coefficient C(T-1) is negative in this case.

1. Population growth

All else remaining the same, greater population growth leads to lower GDP growth per capita.[6]

2. Inflation rate

The higher inflation rate obviously increases the nominal GDP growth per capita due to the higher price.

There are many theoretical studies on the effect of inflation rate on real GDP per capita. Many people will say the higher inflation rate reduces the rate of investment by preventing long term projects or by increasing the option value of delaying an investment which cannot be started over from the beginning. Friedman (1977) and Fischer and Modigliani (1978) also describe that the higher inflation rate will reduce the allocative efficiency of the price system. To the contrary, Dotsey and Sarte (2000) present that the higher inflation rate may increase investment in a cash-in-advance economy because it provides people with an incentive to spend savings of which real values are decreasing.

There are also many empirical works on the inflation rate and they have been found to negatively affect the real GDP growth per capita. Elder (2004) showed that uncertainty about inflation has significantly reduced real economic activity over the post-1982 period.

Taking account of the fact that the sample countries in this paper are all developed countries where the economies are not cash-in-advance, the effect of inflation rate on real GDP growth per capita appears to be negative.

3. Investment share in GDP

Greater investment shares have shown to be positively correlated with economic growth. Robert E. Lucas (1988) demonstrates theoretically that capital accumulation is the important factor of economic growth. In addition to that, De Long and Summers (1991) provide quantitative evidence that accumulation of machinery is a prime determinant of national rates of productivity growth by an empirical method. Equipment investment has more explanatory power for economic growth than other determinants. Although non-equipment investment has weaker explanatory power than that of equipment investment, the coefficient of non-equipment investment is still positive. Mankiw et al (1992) shows that R&I investment is the key of economic growth by an empirical method.

4. Government share in GDP

As Gwartney et al (1998) shows, excessively large governments are expected to crowd out

[6] For example, let me assume the production function is $Y = a*L^{m}* K^{n}$, where Y stands for GDP, L for population, K for capital, a, m, n are parameters. In this case, GDP per capita is $Y/L = a*L^{(m-1)}*K^{n}$. Since the parameter m and n are smaller than 1 because of the decreasing marginal productivity, $(m-1)$ is negative. Therefore, the greater population leads to lower GDP per capita.

resources from the private sector and be harmful to economic growth.

Studies on the relationship between government size and economic growth show that if governments undertake activities related to productivity, at first government expenditures will promote economic growth, but additional expenditures will eventually retard growth. Taking OECD countries as the sample, Gwartney et al (1998) demonstrates that government expenditures as a share of GDP has a negative effect on investment as a share of GDP and real GDP growth. A larger size of government will crowd out more beneficial private investment and lead to lower economic growth. As the countries in our sample are not developing countries but well-developed countries, the higher rate of government expenditure share in GDP will reduce economic growth.

Also, the idea that the government expenditure share in GDP is higher in recession than in prosperity is consistent with the fact that the government is a built-in stabilizer. The government spends more money in the recession and less during prosperity to stabilize the economy.

5. Trade openness

Recent empirical studies on the relationship between trade openness and economic growth demonstrate that the trade openness in a country, which is calculated as the share of the sum of its imports plus its exports in GDP, has a positive effect on economic growth.

In the theory of international trade, the static gains from trade and losses from trade restrictions have been examined thoroughly, but there is a criticism that trade theory provides little guideline as to the effects of international trade on growth and technical progress. Looking at empirical studies, a wide variety of them have made use of an assortment of cross-country growth regressions to test endogenous growth theory and the importance of trade policies. Due to the difficulty in measuring openness, different researchers have used many different measures to examine the effects of trade openness on economic growth. The most basic measure of openness is the simple trade shares, which is exports plus imports divided by GDP. Using this definition of trade openness, Harrison (1996), Frankel and Romer (1999), Irwin and Tervio (2002) and Halit Yanikkaya (2002) show empirically there is a positive effect of trade openness on economic growth.

6. VAT rate change

This is the same as the case of the effect on aggregate consumption.

Section 3: Empirical model and data

Quarterly data from 1980 Q2 to 2010 Q3 are gathered for 14 countries. The sources of economic data except for the VAT rate change were the International Monetary Fund's *International Financial Statistics* (IFS) and OECD's *Revenue Statistics*. Since IFS data are seasonally adjusted, we do not need to consider seasonal factors.

(1): The effect on aggregate consumption

The equation is;

$$\text{Change of aggregate consumption} = B_1 * [\text{Change of dispensable income}]_{i,t} + B_2 * [\text{Expected inflation rate}]_{i,t} + B_3 * [\text{Change of interest rate}]_{i,t} + B_4 * [C(T)]_{i,t} + B_5[C(T+1)]_{i,t} + B_6[C(T-1)]_{i,t} + a_i + u_{i,t}$$

Variable description

1. Change of aggregate consumption (Dependent variable)

Transform the original data, which is quarterly aggregate consumption in national currency seasonally adjusted, by taking the percent change from the previous quarter to the current quarter.

Data source: IFS

2. Change of dispensable income (Independent variable 1)

The original data are seasonally adjusted GDP from IFS and total tax revenue as percent of GDP[7] from OECD Revenue Statistics. Dispensable income can be obtained by subtracting the total tax revenue from the GDP. Transform the dispensable income by taking the percent change from the previous quarter to the current quarter.

A positive coefficient is expected.

Data source: IFS and OECD Revenue Statistics

3. Expected inflation rate (Independent variable 2)

Assuming that people always predict the inflation rate correctly, the expected inflation rate is the inflation rate in the next period. Transform the original data which is quarterly CPI by taking the percent change from the current quarter to the next quarter.

The expected sign of the coefficient is ambiguous.

Data source: IFS

4. Change of interest rate change (Independent variable 3)

[7] Since there is only annual data on tax share, this paper assume that the tax share in each quarter in a year is the same.

Take the percent change of the government bond yield[8] from the previous quarter to the current quarter.

The expected sign of the coefficient is ambiguous.

Data source: IFS

5. Change of the VAT rate: C(T), C(T+1), C(T-1) (Independent variable 4, 5, 6)

The unit is percent.

A positive coefficient is expected for C(T+1) while a negative coefficient is expected for C(T).

For C(T-1), it is ambiguous because the expected inflation rate is raised due to the expected rise in the VAT rate just before the implementation and it affects the change of aggregate consumption.

Data source: See Table 12.

Descriptive statistics of the variables included in the tables of results are shown in Table 2. More details are shown Table 13.

Table 2

	Obs.	Mean	St. Dev	Min.	Max.
Change of aggregate consumption	1708	1.482	3.406	-16.003	23.910
Change of dispensable income	1708	1.463	3.771	-13.587	21.288
Expected Inflation rate	1722	0.906	1.096	-2.135	8.468
Change of interest rate	1708	-1.008	7.981	-52.266	91.476
Change of VAT rate : C(T)[9]	52			-2.5	22
Change of VAT rate : C(T+1)[10]	48			-2.5	22
Change of VAT rate : C(T-1)[11]	41			-1.5	16

[8] As for Finland, this paper takes the change of average cost of central bank debt since the government bond yield is missing. When there are both short-term government bond yield and long-term government bond yield, this paper takes the short-term yield. It is better to take shorter-term interest rates but they are missing.

[9] Since C(T), C(T+1) and C(T-1) are like dummy variables, their mean and standard deviation are meaningless and omitted.

[10] The reason that the number of observation of C(T+1) is four less than that of C(T) is that three countries (Finland, Portugal and Spain) raise the VAT rate in 2010 Q3 (there is no data on 2010 Q4) and C(T+1) in Italy in 1980 Q4 is eliminated (See Table 12) .

[11] In order to understand the reason that the number of observation of C(T-1) is less than that of C(T) and that of C(T+1), see footnote 5.

This regression is estimated using random effects. Since the independent variables are not the level but the percent change, they are not so different among countries (See Table 13) that this regression does not need to use a fixed effect estimator.

The result of Hausman test supports this idea. The p-value is 0.99, which means that we cannot reject the null hypothesis that the correlation between a_i and the explanatory variables is 0, so it is better to use a random effect estimator.

(2): The effect on economic growth

The equation is;

$$\begin{aligned}\text{Nominal (Real) GDP growth per capita} = {} & B_1 * [\text{Population growth}]_{i,t} \\ & + B_2 * [\text{Inflation rate}]_{i,t} \\ & + B_3 * [\text{Investment share of GDP}]_{i,t} \\ & + B_4 * [\text{Government share of GDP}]_{i,t} \\ & + B_5 * [\text{Trade openness}]_{i,t} \\ & + B_6 * [C(T)]_{i,t} + B_7[C(T+1)]_{i,t} + B_8[C(T-1)]_{i,t} + a_i + u_{i,t}\end{aligned}$$

Variable description

1. Nominal GDP growth per capita (Dependent variable 1)

Transform the original data, which is quarterly nominal GDP in national currency seasonally adjusted, by dividing by the total population and taking the percent change from the previous quarter to the current quarter.

Data source: IFS

2. Real GDP growth per capita (Dependent variable 2)

Transform the original data, which is quarterly real GDP in national currency seasonally adjusted, by dividing by the total population and taking the percent change from the previous quarter to the current quarter.

Data source: IFS

3. Population growth (Independent variable 1)[12]

A negative coefficient is expected.

Data source: IFS

[12] Since there is only annual data on population, this paper assume that the population growth in each quarter in a year is the same.

4. Inflation rate (Independent variable 2)

Transform the original data which is quarterly CPI by taking the percent change from the previous quarter to the current quarter.

For nominal GDP growth per capita, a positive coefficient is expected. For real GDP growth per capita a negative coefficient is expected.

Data source: IFS.

5. Investment share in GDP (Independent variable 3)

Data source: IFS

The unit is percent of GDP. A positive coefficient is expected.

6. Government share in GDP (Independent variable 4)

Data source: IFS

The unit is percent of GDP. A negative coefficient is expected.

7. Trade openness (Independent variable 5)

This is the percent share of the sum of the import and the export in GDP.

A positive coefficient is expected.

8. Change of VAT rate: C(T), C(T+1), C(T-1) (Independent variable 6, 7, 8)

The unit is percent.

In the regression for nominal GDP growth per capita, positive coefficients are expected for all coefficients. The coefficient of C(T) should be positive because the price is raised [or reduced] due to the rise [or reduction] of the VAT rate, and the coefficients of C(T-1) and C(T+1) should be positive as Graph 1 and Graph 2 show.

In the regression for real GDP growth per capita, positive coefficients are expected for C(T-1) and C(T+1) and a negative coefficient is expected for C(T) as Graph 1 and Graph 2 show.

Data source: See Table 12.

Descriptive statistics of the variables included in the tables of results are shown in Table 3. More details are shown Table 13.

Table 3

	Obs.	Mean	St. Dev	Min.	Max.
Nominal GDP growth per capita	1722	1.398	3.688	-13.446	23.487
Real GDP growth per capita	1708	0.511	4.123	-14.664	24.667

Population growth	1722	0.101	0.080	-0.063	0.369
Inflation rate	1722	0.928	1.096	-2.135	8.468
Investment share of GDP	1722	21.266	3.491	13.173	35.506
Government share of GDP	1722	21.072	3.601	12.786	31.826
Trade openness	1722	69.003	30.866	15.574	176.518
Change of VAT rate : C(T)				-2.5	22
Change of VAT rate : C(T+1)				-2.5	22
Change of VAT rate : C(T-1)				-1.5	16

While the regression for the effect on aggregate consumption is estimated using random effects, this regression is estimated using fixed effects. The independent variables such as investment share of GDP or government share of GDP is different among countries as Table 13 shows. The regression should be done with a fixed effect estimator because the fixed effect estimator allows for arbitrary correlation between a_i and the independent variables in any time period.

The result of Hausman test supports this idea. The p-value is 0.00, which means that we can reject the null hypothesis that the correlation between a_i and the explanatory variables is 0, so it is better to use the fixed effect estimator.

Section 4: Empirical Results

(1): The effect on aggregate consumption

The result of the regression is shown in Table 4.

Table 4

Dependent variable: Change of aggregate consumption

	Coefficient	Standard error	P-value
Change of dispensable income	0.7453 ***	0.012	0.000
Expected Inflation rate	0.2999 ***	0.044	0.000
Change of interest rate	-0.0122 **	0.006	0.033
Change of VAT rate : C(T)	-0.2167 ***	0.057	0.000
Change of VAT rate : C(T+1)	0.0924	0.057	0.106
Change of VAT rate : C(T-1)	-0.0012	0.081	0.988

The number of observations = 1708

The number of groups (countries) = 14

The number of time periods = 122 (from 1980Q2 to 2010Q3)

R-squared within = 0.6982

Note: Significance level at which the null hypothesis is rejected: ***, 1 percent; **, 5 percent;
*, 10 percent

The coefficients of change of dispensable income, expected inflation rate and C(T) are highly statistically significant because their p-values are 0.000. The signs of change of dispensable income and C(T) are exactly same as the expectation. The coefficient of change of interest rate is also sufficiently significant because its p-value is 0.033, less than 5%. The coefficient of C(T+1) is not statistically significant but its p-value is not so high: 0.106 is close to 10%. The sign is positive, which is the same as the expectation.

The coefficient of C(T-1) is not statistically significant, but the reason is clear. Since the expected inflation rate is high [or low] due to the rise [or reduction] in the VAT rate just before the change, aggregate consumption increases due to the increase of the expected inflation rate. The result of a simple regression, in which the dependent variable is the expected inflation rate and the independent variable is C(T-1), supports this idea. This is shown in Table 5.

Table 5

Dependent variable: Expected inflation rate

	Coefficient	Standard error	P-value
Change of VAT rate : C(T-1)	0.2399***	0.043	0.000

The coefficient of C(T-1) is highly statistically significant and positive, which means that aggregate consumption will increase through the expected inflation rate just before the change in the VAT rate. The result of the regression excluding C(T-1) is shown in Table 6.

Table 6

Dependent variable: Change of aggregate consumption

	Coefficient	Standard error	P-value
Change of dispensable income	0.7450 ***	0.012	0.000
Expected Inflation rate	0.2919 ***	0.047	0.000
Change of interest rate	-0.0120 **	0.006	0.035
Change of VAT rate : C(T)	-0.2183 ***	0.057	0.000
Change of VAT rate : C(T+1)	0.0908	0.057	0.114

This result is similar to Table 4.

There are two more results that should be noticed. First, the coefficient of C(T) is more significant than that of C(T+1). Secondly, the absolute value of the coefficient of C(T) is larger than

that of C(T+1). These two results make sense because the decrease [or increase] just after the implementation of the change in the VAT rate is relatively dramatic while the increase [or decrease] after the dramatic change is gradual as Graph 1 [Graph 2] shows.

Although the coefficient of C(T+1) is not statistically significant, the regression demonstrates that the aggregate consumption increases [or decreases] through the expected inflation rate just before the rise [or reduction] in the VAT rate and decreases [or increases] relatively dramatically just after the implementation of the raise, as Graph 1 [Graph 2] shows.

(2): The effect on economic growth

The result of the regression for nominal GDP growth per capita is shown in Table 7.

Table 7

Dependent variable: Nominal GDP growth per capita

	Coefficient	Standard error	P-value
Population growth	-7.2160 ***	1.581	0.000
Inflation rate	0.3387 ***	0.087	0.000
Investment share of GDP	0.3776 ***	0.040	0.000
Government share of GDP	-0.2436 ***	0.060	0.000
Trade openness	-0.0069	0.008	0.326
VAT rate change : C(T)	0.3438 ***	0.107	0.001
VAT rate change : C(T+1)	0.2023 *	0.106	0.057
VAT rate change : C(T-1)	0.2939 **	0.148	0.048

The number of observations = 1722

The number of groups (countries) = 14

The number of time periods = 123 (from 1980Q1 to 2010Q3)

R-squared within = 0.1262

F test that all u_i =0, F-statistics is 7.49 and P-value is 0.000.

Note: Significance level at which the null hypothesis is rejected: ***, 1 percent; **, 5 percent;
*, 10 percent

The coefficients of change of population, inflation rate, investment share of GDP, government share of GDP and C(T) are highly statistically significant because their p-values are less than 0.001. Their signs are exactly the same as the expectation. The coefficients of C(T+1) and C(T-1) are statistically significant at the 10% level and their signs are exactly same as the expectation, but not significant at the 5% level.

The fact that the coefficients of the inflation rate and C(T) are positive means that the rise [or

reduction] in the VAT rate will raise [or reduce] the nominal GDP through the inflation rate and C(T). The result of the regression for inflation rate on C(T) shown in Table 8 means that the rise in the VAT rate makes the inflation rate higher since the coefficient is positive and statistically significant. The result of regression excluding C(T) shown in Table 9 also supports this idea because the coefficient of inflation rate is still statistically significant and higher than that of the regression including C(T) (0.3745 > 0.3387).

Table 8

Dependent variable: Inflation rate

	Coefficient	Standard error	P-value
Change of VAT rate : C(T)	0.1409***	0.031	0.000

Table 9

Dependent variable: Nominal GDP growth per capita

	Coefficient	Standard error	P-value
Population growth	-7.0690 ***	1.581	0.000
Inflation rate	0.3745 ***	0.087	0.000
Investment share of GDP	0.3604 ***	0.040	0.000
Government share of GDP	-0.2513 ***	0.060	0.000
Trade openness	-0.0080	0.008	0.326
VAT rate change : C(T+1)	0.1942 *	0.106	0.057
VAT rate change : C(T-1)	0.2847 *	0.148	0.069

The coefficient of trade openness is not statistically significant at all. The reason seems to be that there are few countries (14) in this regression and they are all developed countries. Halit Yanikkaya (2002) which shows the trade openness has a positive effect on economic growth apply to a panel of over 100 developed and developing countries from 1970 to 1997. While small trade openness in a developing country means that the country is not open widely to the world, small trade openness in a developed country may means that the country has a large domestic demand. This is why the regression in this paper does not show a positive and statistically significant coefficient of trade openness.

The result of the regression for real GDP growth per capita is shown in Table 10.

Table 10

Dependent variable: Real GDP growth per capita

	Coefficient	Standard error	P-value

Population growth	-7.9137 ***	1.849	0.000
Inflation rate	-0.3305 ***	0.104	0.002
Investment share of GDP	0.4137 ***	0.048	0.000
Government share of GDP	-0.2536 ***	0.070	0.000
Trade openness	-0.0002	0.009	0.981
VAT rate change : C(T)	0.0505	0.125	0.686
VAT rate change : C(T+1)	0.2126 *	0.124	0.085
VAT rate change : C(T-1)	0.3033 *	0.172	0.079

The number of observations = 1708

The number of groups (countries) = 14

The number of time periods = 122 (from 1980Q2 to 2010Q3)

R-squared within = 0.0749

F test that all u_i =0, F-statistics is 6.08 and P-value is 0.000.

Note: Significance level at which the null hypothesis is rejected: ***, 1 percent; **, 5 percent; *, 10 percent

The coefficients of change of population, inflation rate, investment share of GDP, and government share of GDP are highly statistically significant because their p-values are less than 0.002. Their signs are exactly same as the expectation. The coefficients of C(T+1) and C(T-1) are statistically significant at the 10% level and their signs are exactly same as the expectation, but not significant at the 5% level.

Although the coefficient of C(T) is not statistically significant, the rise [or reduction] in the VAT rate will reduce [or raise] real GDP growth per capita through the inflation rate in the period just after the implementation, as this paper already explained, in the regression for nominal GDP growth per capita. The reason that the coefficient of trade openness is not statistically significant is the same as the regression for nominal GDP growth per capita.

The result of the regression excluding C(T) is shown in Table 11.

Table 11

Dependent variable: Real GDP growth per capita

	Coefficient	Standard error	P-value
Population growth	-7.8907 ***	1.848	0.000
Inflation rate	-0.3249 ***	0.104	0.002
Investment share of GDP	0.4111 ***	0.047	0.000
Government share of GDP	-0.2548 ***	0.070	0.000
Trade openness	-0.0004	0.009	0.967
VAT rate change : C(T+1)	0.2114 *	0.123	0.087

VAT rate change : C(T-1)	0.3019 *	0.172	0.080

The regression demonstrates that real GDP growth per capita increases [or decreases] just before the rise [or reduction] in the VAT rate, and decreases [or increases] just after the implementation, and increases [or decreases] again after the decrease [or increase] as Graph 1 [Graph 2] shows.

Section 5: Conclusion

The results of regression show that the trend of aggregate consumption and real GDP growth per capita when the VAT rate is raised [or reduced] is like Graph 1 [Graph 2]. This suggests that governments should be careful regarding the timing of the change in the VAT rate in order to avoid excessive recession or prosperity.

Although most of the VAT variables are statistically significant at the 10% level, some VAT variables are not highly statistically significant (they are not significant at 5% level). There are two reasons that can be considered. First, the change of aggregate consumption and economic growth is dramatic only during the period when the VAT rate is changed, as Graph 1 and Graph 2 show. Other changes are relatively gradual. This is one reason why the regression did not show the high significance of some VAT variables. The other reason may be lack of data and variables as follows.

There are only 53 cases of the change in the VAT rate among 14 countries in the sample of this paper.[13] In actuality, quarterly data are too limited to incorporate many countries in the sample. If quarterly data would be available among many countries, this paper would have more cases and the result would be improved. If possible, it is obviously better to have more monthly data because the VAT rates are sometimes changed in the middle of the quarter (in order to solve this problem, this paper needs to make assumptions and adjustments, see Footnote 5).

It may be better to put more variables in the regressions. As Robert J. Barro (1991) suggests that human capital is a key factor for economic growth, it makes sense to add primary school enrollment to the equation. Legal determinants can be added; as La Porta et al (1988) and Daniel Berkowitz (2003) show, the rules of law have an impact on economic growth. A coefficient to measure democracy can be also incorporated; as Acemoglu et al (2008) showed, there is a correlation between income and democracy. However, quarterly data on the variables above were missing so that this paper ignores these variables.

It also makes sense to take into account the difference in the cases of the change in the VAT rate. First, the positive [or negative] effects on aggregate consumption and economic growth just before the rise [or reduction] in the VAT rate will depend on when it has been announced. The earlier it is

[13] Accurately saying, there are only 52 C(T)s in the regression because C(T) in Italy in 1980Q4 is eliminated (See footnote 17).

announced, the weaker the positive effects will be. Second, if the government implements a policy in order to offset the negative [or positive] effect of the rise [or reduction] in the VAT rate on aggregate consumption and economic growth, the negative [or positive] effect just after the implementation of the change will be weaker. This paper does not take this point into account because the trend is the same, yet if it is considered the regression will be more accurate. Third, this paper does not focus on a reduced VAT rate or increased VAT rate. It may be meaningful to count consider it.

It may be possible to make the regressions more precise by the ways described above. I hope further research on this topic will be done in the future when more data becomes available.

Section 6: References

Ann Harrison (1996). "Openness and growth: a time series, cross-country analysis for developing countries" *Journal of Development Economics* Vol. 48, pp. 419 - 447

Badi H. Baltagi (2008). "Econometric Analysis of Panel Data" 4th ed.

Daniel Berkowitz, Katharina Pistor, Jean-Francois Richard (2003). "Economic development, legality, and the transplant effect" *European Economic Review* No. 47, pp. 165 - 195

Daron Acemoglu, Simon Johnson, James A. Robinson, and Pierre Yared (2008). "Income and Democracy" *American Economic Review* 2008, 98:3, pp. 808 - 842

Douglas A. Irwin and Marko Tervio (2002) "Does trade raise income? Evidence from the twentieth century" *Journal of International Economics* Vol. 58, pp. 1 - 18.

Hali J. Edison, Ross Levineb, Luca Riccia and Torsten Sløka (2002). "International financial integration and economic growth" *Journal of International Money and Finance* No. 21, pp. 749 - 776

Halit Yanikkaya (2002). "Trade openness and economic growth: a cross-country empirical investigation" *Journal of Development Economics* No. 72 (2003) pp. 57 – 89

J. Bradford De Long and Lawrence H. Summers (1991). "Equipment Investment and Economic Growth," *The Quarterly Journal of Economics*, Vol. 106, No. 2: pp. 445 – 502

James Gwartney, Robert Lawson and Randall Holcombe (1998) "The size and functions of government and economic growth" *Joint Economic Committee*

Jeffrey A. Frankel and David Romer (1999) “Does trade cause growth?” *American Economic Review* Vol. 89 (No. 3), pp. 379 - 399.

Jeffrey M. Wooldridge “Introductory Econometrics” 3rd ed.

John Elder (2004). “Perspective on the Effects of Inflation Uncertainty” *Journal of Money, Credit and Banking*, Vol. 36, No. 5 (Oct., 2004), pp. 911 - 928

Mankiw, N.Gregory, David Romer, and David Weil (1992). “A contribution to the empirics of economic growth” *Quarterly Journal of Economics* No. 107: pp. 407 - 38

Michael Dotsey and Pierre Daniel Sarte (2000), “Inflation uncertainty and growth in a cash-in-advance economy” *Journal of Monetary Economics* Vol. 45, pp. 631 - 655

Milton Friedman (1977). “Inflation and unemployment” *Journal of Political Economy* Vol. 85 No. 3 pp. 451-472

OECD (2007) “Consumption Taxes: the Way of the Future?” *OECD Policy Brief* Oct. 2007

Rafael La Porta, Florencio Lopez-de-Silanes, Andrei Shleifer, Robert W. Vishny (1998). “Law and Finance” *The Journal of Political Economy* Vol. 106, No. 6, pp. 1113 - 1155

Robert E. Lucas, Jr (1988), “On the Mechanics of Economic Development” *Journal of Monetary Economics* Vol. 22 (July): pp. 3 - 42

Robert J. Barro (1991). “Economic growth in a cross section of countries” *The Quarterly Journal of Economics*, Vol. 106, No. 2 (May, 1991), pp. 407 - 443

Stanley Fischer and Franco Modigliani (1978) “Towards an understanding of the real effects and costs of inflation” *Weltwirtschaftliches Archive*, Vol. 114, No. 4, pp. 810 - 833

Thorsten Beck (2008). “The Econometrics of Finance and Growth” *Policy Research Working Paper* No. 4608, World Bank

William Hamburger (1954). “The determinants of aggregate consumption” *The Review of Economic Studies*, Vol. 22, No. 1 (1954 - 1955), pp. 23 - 24

Table 12

The change of the VAT rate

	Country	Date (Year. Month. Day)	Rate before the change (%)[14]	Rate after the change (%)	Difference (%)
1	Austria	1984. 1. 1	18	20	2
2	Belgium	1981. 7. 1	16	17	1
3	Belgium	1983. 1. 1	17	19	2
4	Belgium	1992. 4. 1	19	19.5	0.5
5	Belgium	1994. 1. 1	19.5	20.5	1
6	Belgium	1996. 1. 1	20.5	21	0.5
7	Canada[15]	1991. 1. 1	0	7	7
8	Canada	2006. 7. 1	7	6	-1
9	Canada	2008. 1. 1	6	5	-1
10	Denmark[16]	1980. 6.30	20.25	22	1.75
11	Denmark	1992. 1. 1	22	25	3
12	Finland	1994. 6. 1	0	22	22
13	Finland	2010. 7. 1	22	23	1
14	France	1982. 7. 1	17.6	18.6	1
15	France	1995. 8. 1	18.6	20.6	2
16	France	2000. 4. 1	20.6	19.6	-1
17	Germany	1983. 7. 1	13	14	1
18	Germany	1993. 1. 1	14	15	1
19	Germany	1998. 4. 1	15	16	1
20	Germany	2007. 1. 1	16	19	3
21	Italy	1980. 7. 3	14	15	1
22	Italy[17]	1980.11. 1	15	14	-1
23	Italy	1981. 1. 1	14	15	1

[14] All rates are standard rates.

[15] Canada has local VAT: Goods and Service Tax (GST) is added in some provinces in order to implement provincial Harmonized Sales Tax (HST). It is difficult to estimate the impact of the local VAT in Canada because it differs among provinces (It is different from Japan's case). Therefore, this paper ignores the local VAT in Canada.

[16] In this case this paper regards that the raise of VAT rate is implemented 1980. 7. 1. That is, C(T) is 1 in 1980 Q3 and C(T+1) in 1980 Q4 and C(T-1) in 1980 Q2.

[17] Italy changed VAT rate three times from 1980.11. 1. to 1981. 1. 1. During this term, C(T) is 1 in 1980 Q3 and 1981 Q1, C(T+1) is 1 in 1981 Q2, C(T-1) is 1 in 1980 Q2 and others are 0.

24	Italy	1982. 8. 5	15	18	3
25	Italy	1988. 8. 1	18	19	1
26	Italy	1997. 10. 1	19	20	1
27	Japan	1989. 4. 1	0	3	3
28	Japan[18]	1997. 4. 1	3	5	2
29	Netherlands	1984. 1. 1	18	19	1
30	Netherlands	1986.10. 1	19	20	1
31	Netherlands	1989. 1. 1	20	18.5	-1.5
32	Netherlands	1992.10. 1	18.5	17.5	-1
33	Netherlands	2001. 1. 1	17.5	19	1.5
34	Portugal	1986. 1. 1	0	16	16
35	Portugal	1988. 2. 1	16	17	1
36	Portugal[19]	1992. 3.24	17	16	-1
37	Portugal	1995. 1. 1	16	17	1
38	Portugal	2002. 6. 5	17	19	2
39	Portugal	2005. 7. 1	19	21	2
40	Portugal	2008. 7. 1	21	20	-1
41	Portugal	2010. 7. 1	20	21	1
42	Spain	1986. 1. 1	0	12	12
43	Spain	1992. 1. 1	12	13	1
44	Spain	1992. 8. 1	13	15	2
45	Spain	1995. 1. 1	15	16	1
46	Spain	2010. 7. 1	16	18	2
47	Sweden	1980. 9. 8	20.63	23.46	2.83
48	Sweden	1981.11.16	23.46	21.51	-1.95
49	Sweden	1983. 1. 1	21.51	23.46	1.95
50	Sweden	1990. 7. 1	23.46	25	1.54
51	United Kingdom	1991. 4. 1	15	17.5	2.5
52	United Kingdom	2008.12. 1	17.5	15	-2.5
53	United Kingdom	2010. 1. 1	15	17.5	2.5

[18] The consumption tax rate in Japan from 1997. 4. 1 is 5% including 4% central government part and 1% local government part. Estimating the effect on aggregate consumption and on economic growth, it is appropriate to take 5% because the price increased by 2 % for the consumer.

[19] In this case this paper regards that the raise of VAT rate is implemented 1992. 4. 1. That is, C(T) is 1 in 1992 Q2 and C(T+1) in 1992 Q3 and C(T-1) in 1992 Q1.

(Source)

As for Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom;

Europian Commission, *VAT Rates Applied in the Member States of the European Union at1st January*

<http://ec.europa.eu/taxation_customs/taxation/vat/how_vat_works/rates/index_en.htm>

As for Canada;

Canada Revenue Agency, *GST/HST rates*

<http://www.cra-arc.gc.ca/tx/bsnss/tpcs/gst-tps/rts-eng.html>

As for Japan;

Ministry of Finance, *Outline of the Consumption Tax System*

<http://www.mof.go.jp/english/tax_policy/tax_system/japanese_tax_system_1998/zc001e05.htm>

Table 13

The detail of variables (quarterly data) by country

	Obs.	Mean	St. Dev	Min.	Max.
Austria					
Change of aggregate consumption	122	1.370	6.594	-16.003	13.878
Change of dispensable income	122	1.293	5.343	-13.242	9.630
Expected Inflation rate	123	0.651	0.671	-0.849	3.189
Change of interest rate	122	-0.741	5.508	-12.462	19.249
Nominal GDP growth per capita	123	1.172	5.273	-13.011	9.590
Real GDP growth per capita	122	0.727	5.684	-14.664	8.842
Population growth	123	0.085	0.062	-0.026	0.199
Inflation rate	123	0.664	0.689	-0.849	3.189
Investment share of GDP	123	22.006	2.680	14.364	25.980
Government share of GDP	123	19.190	0.991	17.105	21.543
Trade openness	123	83.206	14.625	63.814	117.790
Change of VAT rate : C(T)	1			2	2
Change of VAT rate : C(T+1)	1			2	2
Change of VAT rate : C(T-1)	1			2	2
Belguim					
Change of aggregate consumption	122	1.161	2.682	-3.708	5.936
Change of dispensable income	122	1.224	4.378	-6.384	8.781
Expected Inflation rate	123	0.722	0.656	-0.747	2.621
Change of interest rate	122	-0.924	5.306	-14.126	18.542
Nominal GDP growth per capita	123	1.134	4.297	-4.992	8.724
Real GDP growth per capita	122	0.614	3.791	-5.966	16.058
Population growth	123	0.069	0.047	-0.015	0.143
Inflation rate	123	0.736	0.673	-0.747	2.621
Investment share of GDP	123	20.085	2.041	15.770	24.990
Government share of GDP	123	22.283	1.323	19.791	25.682
Trade openness	123	140.798	13.245	107.682	176.518
Change of VAT rate : C(T)	5			0.5	2
Change of VAT rate : C(T+1)	5			0.5	2
Change of VAT rate : C(T-1)	5			0.5	2
Canada					

Change of aggregate consumption	122	1.468	0.844	-1.430	4.488
Change of dispensable income	122	1.393	1.182	-4.127	4.396
Expected Inflation rate	123	0.839	0.824	-1.498	3.259
Change of interest rate	122	-1.134	9.061	-28.635	31.248
Nominal GDP growth per capita	123	1.133	1.187	-4.354	5.188
Real GDP growth per capita	122	0.350	0.786	-2.036	2.234
Population growth	123	0.271	0.040	0.224	0.364
Inflation rate	123	0.852	0.833	-1.498	3.259
Investment share of GDP	123	20.610	1.718	17.290	24.852
Government share of GDP	123	20.917	1.591	18.455	24.160
Trade openness	123	63.873	11.704	44.781	86.359
Change of VAT rate : C(T)	3			-1	7
Change of VAT rate : C(T+1)	3			-1	7
Change of VAT rate : C(T-1)	3			-1	7
Denmark					
Change of aggregate consumption	122	1.277	4.643	-7.617	11.928
Change of dispensable income	122	1.297	4.415	-9.481	8.281
Expected Inflation rate	123	0.849	0.808	-0.435	4.401
Change of interest rate	122	-1.293	6.926	-16.791	19.061
Nominal GDP growth per capita	123	1.275	4.203	-8.027	8.265
Real GDP growth per capita	122	0.413	4.012	-8.680	7.509
Population growth	123	0.056	0.039	-0.020	0.109
Inflation rate	123	0.866	0.820	-0.435	4.401
Investment share of GDP	123	19.419	1.886	14.412	24.513
Government share of GDP	123	26.320	1.371	24.218	30.263
Trade openness	123	77.807	12.502	59.311	109.505
Change of VAT rate : C(T)	2			1.75	3
Change of VAT rate : C(T+1)	2			1.75	3
Change of VAT rate : C(T-1)	2			1.75	3
Finland					
Change of aggregate consumption	122	1.558	4.493	-9.960	9.422
Change of dispensable income	122	1.536	5.838	-13.587	12.359
Expected Inflation rate	123	0.861	0.896	-0.519	3.985
Change of interest rate	122	-1.341	11.807	-52.268	27.551
Nominal GDP growth per capita	123	1.509	5.649	-13.446	12.274
Real GDP growth per capita	122	0.738	6.582	-13.466	12.100

Population growth	123	0.093	0.025	0.053	0.140
Inflation rate	123	0.877	0.918	-0.519	3.985
Investment share of GDP	123	22.004	4.439	14.112	35.506
Government share of GDP	123	21.807	1.968	17.261	26.644
Trade openness	123	65.253	12.118	42.249	93.325
Change of VAT rate : C(T)	2			1	22
Change of VAT rate : C(T+1)	1			1	1
Change of VAT rate : C(T-1)	1			1	1
France					
Change of aggregate consumption	122	1.286	1.053	-1.066	5.280
Change of dispensable income	122	1.232	1.024	-1.071	4.477
Expected Inflation rate	123	0.821	0.865	-0.509	3.912
Change of interest rate	122	-1.061	6.134	-16.705	19.034
Nominal GDP growth per capita	123	1.155	0.983	-1.679	4.349
Real GDP growth per capita	122	0.318	0.527	-1.671	2.089
Population growth	123	0.124	0.022	0.085	0.166
Inflation rate	123	0.849	0.905	-0.509	3.912
Investment share of GDP	123	19.881	1.382	17.386	23.029
Government share of GDP	123	22.973	0.888	20.570	24.913
Trade openness	123	46.728	3.497	39.729	52.938
Change of VAT rate : C(T)	3			-1	2
Change of VAT rate : C(T+1)	3			-1	2
Change of VAT rate : C(T-1)	2			-1	1
Germany					
Change of aggregate consumption	122	1.009	2.334	-2.161	23.910
Change of dispensable income	122	1.006	1.658	-2.939	14.431
Expected Inflation rate	123	0.552	0.540	-0.559	2.536
Change of interest rate	122	-0.836	6.323	-17.919	19.494
Nominal GDP growth per capita	123	0.987	1.726	-2.884	16.464
Real GDP growth per capita	122	0.454	1.349	-3.416	11.099
Population growth	123	0.037	0.069	-0.063	0.154
Inflation rate	123	0.565	0.554	-0.559	2.536
Investment share of GDP	123	19.796	1.461	17.105	23.499
Government share of GDP	123	19.384	0.728	17.615	21.300
Trade openness	123	61.608	12.452	44.257	90.829
Change of VAT rate : C(T)	4			1	3

Change of VAT rate : C(T+1)	4			1	3
Change of VAT rate : C(T-1)	4			1	3
Italy					
Change of aggregate consumption	122	1.798	1.439	-1.884	6.089
Change of dispensable income	122	1.603	1.704	-2.315	6.372
Expected Inflation rate	123	1.302	1.170	-0.435	5.339
Change of interest rate	122	-0.859	6.312	-18.553	18.239
Nominal GDP growth per capita	123	1.753	1.543	-1.991	6.297
Real GDP growth per capita	122	0.312	0.789	-2.963	4.258
Population growth	123	0.055	0.057	-0.031	0.158
Inflation rate	123	1.352	1.254	-0.435	6.447
Investment share of GDP	123	20.816	1.726	17.930	25.624
Government share of GDP	123	19.190	1.057	16.492	21.887
Trade openness	123	46.486	6.113	34.902	59.814
Change of VAT rate : C(T)	5			1	3
Change of VAT rate : C(T+1)	4			1	3
Change of VAT rate : C(T-1)	2			1	1
Japan					
Change of aggregate consumption	122	0.656	1.075	-2.606	4.074
Change of dispensable income	122	0.571	1.269	-5.286	3.721
Expected Inflation rate	123	0.242	0.687	-1.244	3.179
Change of interest rate	122	-1.283	14.084	-33.742	91.476
Nominal GDP growth per capita	123	0.548	1.225	-5.134	3.632
Real GDP growth per capita	122	0.479	1.132	-5.381	3.066
Population growth	123	0.075	0.064	-0.026	0.200
Inflation rate	123	0.255	0.705	-1.244	3.179
Investment share of GDP	123	26.940	3.339	20.363	32.740
Government share of GDP	123	15.735	2.019	12.992	20.328
Trade openness	123	22.786	5.300	15.574	38.579
Change of VAT rate : C(T)	2			2	3
Change of VAT rate : C(T+1)	2			2	3
Change of VAT rate : C(T-1)	2			2	3
Netherland					
Change of aggregate consumption	122	0.974	0.998	-1.653	3.745
Change of dispensable income	122	1.167	1.523	-5.277	6.428
Expected Inflation rate	123	0.581	0.557	-1.263	2.071

Change of interest rate	122	-0.940	6.000	-14.188	18.663
Nominal GDP growth per capita	123	0.968	0.999	-3.399	3.303
Real GDP growth per capita	122	0.386	0.907	-3.080	3.141
Population growth	123	0.137	0.023	0.097	0.167
Inflation rate	123	0.592	0.565	-1.263	2.071
Investment share of GDP	123	20.866	1.381	17.570	23.275
Government share of GDP	123	24.318	1.471	21.923	29.011
Trade openness	123	117.33	13.973	96.747	148.864
Change of VAT rate : C(T)	5			-1.5	1.5
Change of VAT rate : C(T+1)	5			-1.5	1.5
Change of VAT rate : C(T-1)	5			-1.5	1.5
Portugal					
Change of aggregate consumption	122	2.794	3.436	-7.384	20.140
Change of dispensable income	122	2.793	5.000	-10.775	21.288
Expected Inflation rate	123	1.944	2.019	-0.934	8.468
Change of interest rate	122	-0.653	6.785	-18.808	19.153
Nominal GDP growth per capita	123	2.894	4.945	-10.861	23.487
Real GDP growth per capita	122	0.490	2.900	-7.343	6.329
Population growth	123	0.086	0.078	-0.042	0.294
Inflation rate	123	1.969	2.023	-0.934	8.468
Investment share of GDP	123	24.839	3.297	18.266	32.348
Government share of GDP	123	17.776	2.527	13.458	23.570
Trade openness	123	65.888	5.303	54.786	78.922
Change of VAT rate : C(T)	8			-1	16
Change of VAT rate : C(T+1)	7			-1	16
Change of VAT rate : C(T-1)	6			-1	16
Spain					
Change of aggregate consumption	122	1.947	1.235	-1.967	5.582
Change of dispensable income	122	1.948	1.393	-1.319	7.429
Expected Inflation rate	123	1.323	1.135	-1.651	4.382
Change of interest rate	122	-0.847	6.708	-15.224	19.796
Nominal GDP growth per capita	123	1.936	1.441	-1.764	8.989
Real GDP growth per capita	122	0.498	0.926	-1.982	3.831
Population growth	123	0.158	0.107	0.048	0.369
Inflation rate	123	1.347	1.173	-1.651	4.634
Investment share of GDP	123	24.271	3.013	19.458	30.868

Government share of GDP	123	173.183	1.628	12.786	21.305
Trade openness	123	46.471	9.548	31.013	62.983
Change of VAT rate : C(T)	5			1	12
Change of VAT rate : C(T+1)	4			1	12
Change of VAT rate : C(T-1)	4			1	12
Sweden					
Change of aggregate consumption	122	1.691	6.515	-7.106	16.112
Change of dispensable income	122	1.742	7.464	-9.383	19.041
Expected Inflation rate	123	0.952	1.073	-1.430	4.768
Change of interest rate	122	-0.932	7.399	-22.631	24.874
Nominal GDP growth per capita	123	1.604	7.363	-9.365	19.030
Real GDP growth per capita	122	0.910	10.865	-13.492	24.667
Population growth	123	0.091	0.057	-0.008	0.179
Inflation rate	123	0.986	1.152	-1.430	5.609
Investment share of GDP	123	18.726	2.322	14.648	25.127
Government share of GDP	123	27.403	1.561	24.836	31.826
Trade openness	123	73.780	13.509	52.587	103.375
Change of VAT rate : C(T)	4			-1.95	2.83
Change of VAT rate : C(T+1)	4			-1.95	2.83
Change of VAT rate : C(T-1)	2			1.54	1.95
United Kingdom					
Change of aggregate consumption	122	1.644	0.932	-1.733	3.990
Change of dispensable income	122	1.566	1.193	-1.514	5.742
Expected Inflation rate	123	1.052	1.040	-2.135	5.814
Change of interest rate	122	-1.262	8.506	-26.896	27.769
Nominal GDP growth per capita	123	1.498	0.981	-2.654	3.944
Real GDP growth per capita	122	0.459	0.717	-2.358	2.140
Population growth	123	0.076	0.039	0.006	0.136
Inflation rate	123	1.081	1.091	-2.135	5.814
Investment share of GDP	123	17.467	1.598	13.173	21.855
Government share of GDP	123	20.521	1.429	17.619	23.719
Trade openness	123	54.033	3.997	46.073	64.392
Change of VAT rate : C(T)	3			-2.5	2.5
Change of VAT rate : C(T+1)	3			-2.5	2.5
Change of VAT rate : C(T-1)	2			2.5	2.5